

# Diagnostic Engineering Publications

1410/7010

IBM-POUGHKEEPSIE  
December 31, 1964

001

Subject: Diagnostic Program M003E Program Addressable Clock Test

Sequence Number 259  
Replaces / M003D

M003E replaces and obsoletes M003D. Card number 001 is a System Control Card.

The following correction was made to M003D to create M003E:

FROM:

pglin

1331 ERROR 5 MLCWA START+7, ERREXT+6 03021 D02007 03487X

TO:

pglin

1331 ERROR 5 E MLCWA START+6, ERREXT+6 03021 D02006 03487X

Enclosures: 27 Pages  
Card Deck for CARD ONLY SYSTEMS (as punched by UP51)  
8 Cards - Card Loader (1-7) and 1 Core Clear  
58 Cards No. 001-058 Data Cards  
1 Card Execute Card

Distribution: X 1410 with Program Addressable Clock Feature 5737/5738  
X 7010 with RPQ F97414  
Other



M003  
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M003E

1410/7010

PROGRAM ADDRESSABLE CLOCK TEST

12/31/64

M003  
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8.01.00.0      TEST DESCRIPTION

00.1      MODIFICATIONS

The modifications to M003C are minor in so far as test operation is concerned.

The System Control Card now provides information as to system type.

Timing constants are included to test the clocks operation on a 7010 System.

The Loop on G(C)T instruction routine is now set up to take advantage of RESET & RESTART mode on solid machine failures.

00.2      DESCRIPTION

Proper operation of M003 does not depend on having any other programs run prior to it. It does assume that all CPU instructions are working properly and the G(C)T instruction is at least understood by the CPU circuitry.

The objective of this program is to provide a test of the clock's operation that covers the following areas:

- a.    The transfer of time to a specified location in storage, including the transfer of the busy signal indication.
- b.    The presence of the proper busy signal indication (99999) and the length of time the busy signal is active.
- c.    The advance of the clock from one hundredths position to the next, and the length of time it takes to complete this advance.

## 8.01.00.2 DESCRIPTION (continued)

The method by which this is accomplished is as follows:

A preliminary test is run to establish whether the clock can be further tested and timed. The only acceptable Identifier Digits (I.D.) are 0 and 9. The only acceptable time data are 0xxxx and 99999, the clock time and busy signal indication respectively. Any other time data stored are rejected as errors and are displayed followed by a typed message. In this phase two successive times are stored within given intervals. If the first time stored was 0xxxx, the second must be 99999 in order for the test to proceed to the "Main Body." A time limit of approximately 70 seconds is placed on this advance in case the clock is stopped or the busy switch is not connected.

If the first time data stored was 99999, the second time stored is delayed one second. It must be 0xxxx in order for the test to proceed to the "Main Body." Any failure to meet these conditions is typed out.

The "Main Body" of the test is in two sections. The first section stores the time data needed and times the sequential advances. The second analyzes the data compiled. More specifically, the first section begins by storing time data to use as a starting point. Once a valid starting point has been established, <sup>1</sup>a busy signal indication is stored, compared to (99999) and the duration it is active is timed. The interval between the termination of the busy signal indication just timed and the next busy signal indication is computed to complete the timing of an advance of one hundredths position digit. Finally, the next clock time available is stored and typed out for a visual comparison with the clock itself.

Programmed comparisons are made of the time the busy signal indication is active,  $345 \pm 115$  milliseconds, and a total time to advance one hundredths position,  $60 \pm 1$  seconds. The time data stored are checked to see if the clock advanced properly to the next hundredths position. If any of these conditions are not met, an error message preceded by an asterisk (\*) is typed to this effect.

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<sup>1</sup> See Operating Hints and Comments, Section 8.01.03.4.



8.01.00.2 DESCRIPTION (continued)

Three passes are made (6 minutes) covering all hundredths position digits in order and one advance to the next higher tenths position.<sup>1</sup> Only the time stored after every second advance will be typed unless all test data is requested in a summary typeout.

00.3 EQUIPMENT

M003 tests the Program Addressable Clock Feature (Feature No. 5737/5738 on the 1410 System, RPQ F97414 on the 7010 System).  
System type, CPU speed, memory size and I/O devices attached are irrelevant.

00.4 CARD DECK

A complete card deck of M003 contains:

7 Cards	Load Program
1 Card	Core Clear
Data cards <sup>1</sup>	M003 Program Deck
1 Card	Execute (Branch to 2000)

00.5 EC LEVEL OF SYSTEM

1410:  
Minimum EC level EC 251784 (Program Addressable Clock Logic Change). EC 252311 should be applied as soon as possible. It is not essential to the program's operation but does increase clock reliability.  
7010:  
None

8.01.01.0 LOADING PROCEDURE

Use Standard 1410/7010 Diagnostic Loading procedure. Refer to "1410/7010 Introduction," Volume 1.00 for further information.

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<sup>1</sup> Refer to Release Sheet for exact number of cards.

## 8.01.02.0

OPERATING PROCEDURE

No manual intervention is required to run this test. Program operation can be altered at any time using the "Program Alter Routine." TADS are loaded as blanks and TAD locations are only tested for 1.

NOTE: During the period when the busy time and advance time are being computed, no Inquiry Request is acknowledged. Consequently a delay of up to two minutes may be encountered between the time the request is made and entry through the keyboard is possible.

## STANDARD TADS

<u>TAD</u>	<u>ADDRESS</u>	<u>NOT 1</u>	<u>1</u>
TAD 0	01000	Do Not	Bypass Typeouts
TAD 1	01001	Do Not	Loop on Routine
TAD 2	01002	Do Not	Halt on Error
TAD 3	01003	Do Not	Repeat Program

## SPECIAL TAD

TAD 4	01004	Do Not	Typeout Summary
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8.01.03.0

OPERATING HINTS AND COMMENTS

1. Some additional notes on TADs

Standard TADs

TAD 0      Not interrogated. It is not possible to bypass either the clock time timeout given upon the completion of a pass or any of the error timeouts. To loop on the G(C)T instruction with no timeouts see note following TAD 1.

TAD 1 = 1   Provides entry to a three instruction loop containing the G(C)T instruction. Entry is possible from the body of the program or after an error message. To leave this loop, set TAD 1 to not 1.

NOTE: On entering the Loop on G(C)T instruction routine the branch instruction at location 00001 is changed to provide for an automatic branch back to the aforementioned routine on a system check. Setting TAD 1 to 1 and the CHECK CONTROL switch to RESET & RESTART will keep the test in this loop on any SYSTEM CHECK.

8.01.03.0

OPERATING HINTS AND COMMENTS (continued)

TAD 2                      Not interrogated (see Error Halts)

TAD 3 = 1                  The test will normally run three passes (6 minutes). If TAD 3 is set to a 1, passes are made repeatedly disregarding the count. Should TAD 3 be returned to 1, the test will terminate when the pass count reaches three.

Special TAD

TAD 4 = 1                  Provides summary typeout of all time data stored as well as the length of time the busy signal was active and the length of time to advance one position.

2.     The total time to advance one hundredths position digit is compared to 59 seconds as a lower limit and 61 as an upper. Though specifications do not clearly define these limits, maximum permissible power line frequency variation tolerances and the testing done during the evolution of this program indicate these limits are reasonable.
3.     Three passes of this program require a little over six minutes operating time. This is a minimum test. Time permitting nine passes (18 minutes) would be better since three passes cover only one third of the hundredths position digits on the hundredths position wheel.
4.     Due to the fact that the busy switch contacts bounce considerably when transferring from a busy to a ready status, a one-second delay is included to cover this interval in order to accomplish timing of sequential events. This one-second delay should be more than enough to cover the worst case. Should random indications over a longrun imply that the busy time and/or the time to advance was extraordinarily small or that the clock went through a ready-busy-ready sequence without advancing, a badly bouncing busy switch could be the cause.

#### 8.01.04.0 PROGRAM STOPS AND RESTARTS

Only one normal halt is used in this program and it is in the Preliminary Test portion only. The stop occurs after the message

##### \* FAILURE TO ADVANCE INDICATED

Pressing START will cause the Preliminary Test to be repeated.

#### 8.01.05.0 TYPEOUTS

##### 05.1 NORMAL TYPEOUTS

The only normal typeout (not under TAD control) is the clock time. It is typed on the completion of each pass (two minutes) for visual comparison with the clock itself.

CLOCK TIME 0xxxx

Should a summary typeout be requested by setting TAD 4 to 1, the following data are typed:

TIME A 0xxxx

TIME B 9xxxx

TIME C 0xxxx

TIME D 9xxxx

TIME E 0xxxx

BUSY TIME xxx MS

Total time busy signal active.

TIME TO ADVANCExxxxxMS Total time to advance one hundredths position digit.

Times A through E are the time data stored during sequential advances. Times A, C, E should be clock times. Times B and D should be 99999.

EOJ

Typed on conclusion of the test.

8.01.05.0      TYPEOUTS (continued)

05.1      NORMAL TYPEOUTS

NO SYS CARD

This message is typed only if the test is being run without a System Control Card. You may continue from this point by entering the correct system type in location 01256. Enter:

- O    For 1410 Standard
- I    For 1410 With the Accelerator Feature
- X    For 7010

and press START.

05.2      ERROR TYPEOUTS

All error typeouts are preceded by asterisks (\*).

During the running of the Preliminary Test, eight combinations of the following error typeouts are possible:

\* TIME 1 xxxxxx

The first time data stored.

\* TIME 2 xxxxxx

The second time data stored.

\* INVALID ID

Typed if the ID of the first time data stored is invalid.

\* ADVANCED TO INVALID ID

The ID of the first time data stored is acceptable, the second is not.

\* FAILURE TO ADVANCE INDICATED

The ID of the first time data is 0. The ID of the second time stored did not become 9 after more than a 70-second waiting period.

\* READ OUT FAILURE

The ID of the time data stored was a 9 but the remaining four digits were not 9999, i. e., not a busy signal.

\* STUCK ON BUSY OR  
\* READ OUT FAILURE

The first time data stored is 99999. The second time data stored more than one second later is 99999. This is either a continuous busy signal indication or a continuous failure to read out the hundredths position.

During the main body of the program the following error messages may occur:

\* TIME X WAS xxxxxx EXPECTED 99999

X is filled in with either a B or a D.  
xxxxxx is filled in with the actual time data in question.

The message is typed if during the timing of sequential advances. The ID changes from 0 to 9 but the following four digits are not 9999, i. e., not a busy signal indication but a read out failure.

\* BUSY TIME WAS xxx MS - NOT IN SPECS

The busy signal indication should be active for not less than 230 milliseconds and not more than 460 milliseconds. The message is typed if it is not within tolerance.

\* TIME TO ADVANCE xxxxxx MS - CHECK

The hundreths position digit should advance once per minute. If the time to advance is less than 59 seconds or more than 61 seconds, the above message is typed.  
It is advisable to check this area further.<sup>1</sup>

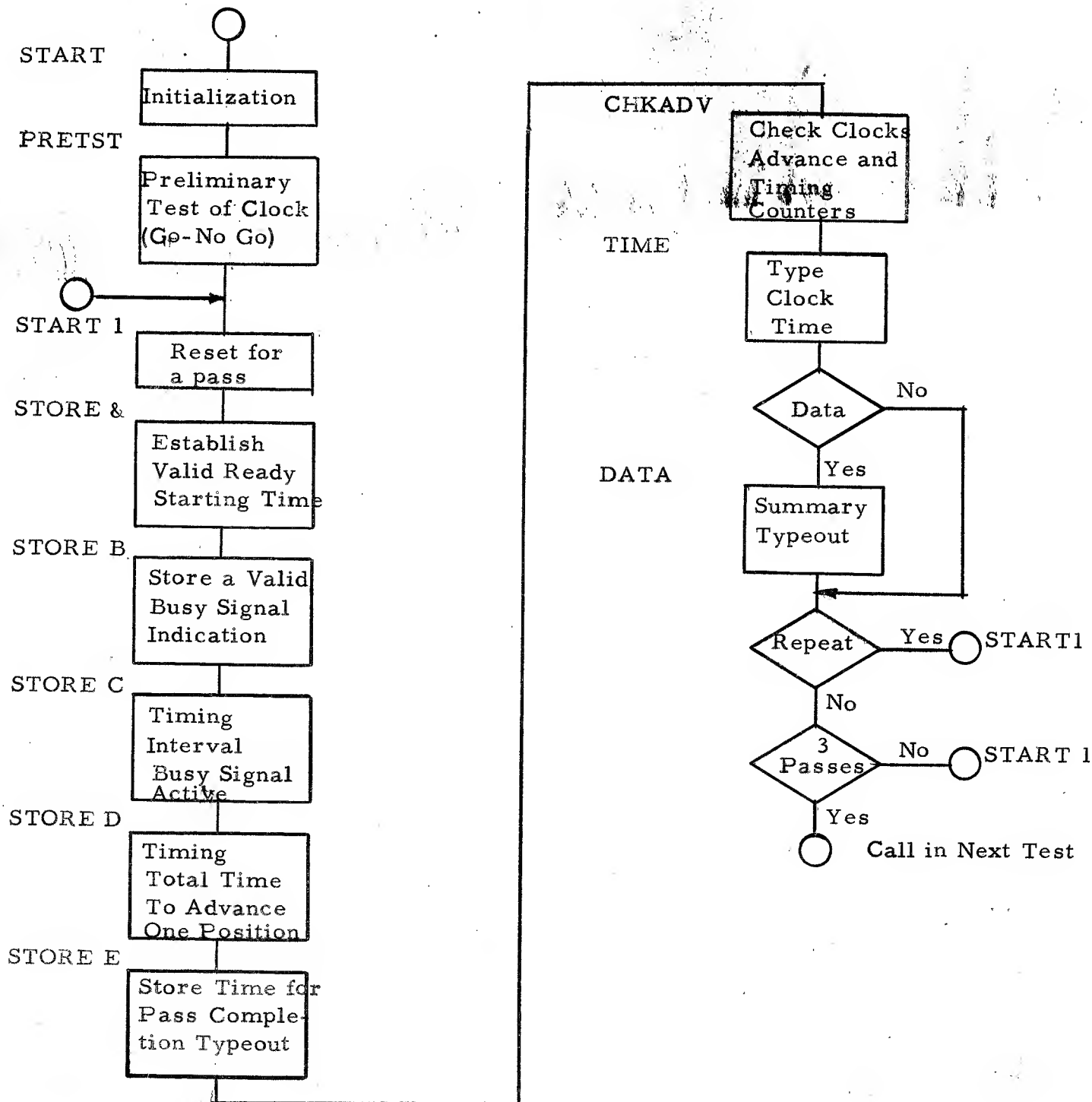
\* TIME WAS xxxxxx ADVANCED TO xxxxxx

The time data stored following each advance are compared to their previous values with the hundreths position digit increased to the next position. Should the comparison indicate that the clock did not advance properly, the above message is typed.

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<sup>1</sup> See Operating Hints and Comments, Section 8.01.03.0.2







PROGRAM ADDRESSABLE CLOCK TEST

PGLIN	LABEL	OPCODE	OPERAND	ADDRESS OF LOAD PROGRAM
1002	LOADER	EQU	400	
1003				
1004				
1005	*			SUMMARY OF TEST OBJECTIVES AND OPERATION
1006	*			TEST CLOCK OPERATION COVERING FOLLOWING AREAS
1007	*			1 TRANSFER OF TIME TO A SPECIFIED AREA IN STORAGE
1008	*			INCLUDING TRANSFER OF BUSY SIGNAL INDICATION
1009	*			2 PROPER BUSY SIGNAL INDICATION, 99999
1010	*			LENGTH OF TIME IT IS ACTIVE
1011	*			3 ADVANCE TO THE NEXT POSITION
1012	*			LENGTH OF TIME TO COMPLETE ADVANCE
1013	*			*****
1014	*			PRE TEST CAN CLOCK BE TESTED AND TIMED
1015	*			IS THE I.D. A 0 OR 9
1016	*			DOES THE I.D. CHANGE AT ALL
1017	*			IS I.D. OF 9 FOLLOWED BY 9999
1018	*			MAIN BODY STORE DIGITS, TIME SEQUENTIAL EVENTS
1019	*			A GET A GOOD STARTING POINT
1020	*			B WAIT TILL BUSY, REALLY BUSY
1021	*			C TIME LENGTH OF BUSY SIGNAL
1022	*			D TIME INTERVAL TILL BUSY AGAIN
1023	*			E STORE TIME FOR TYPEOUT
1024	*			CHECK DATA CHECK ADVANCE AND TIMING
1025	*			BUSY TIME IN TOLERANCE 230-460 MS
1026	*			TIME TO ADVANCE WITHIN 59-61 SECS
1027	*			ADVANCE TO NEXT DIGIT CORRECTLY
1028	*			COMPLETE PASS BY TYPING CLOCK TIME
1029	*			FOR VISUAL COMPARISON
1030	*			NOTE CLCK TIME WILL BE TYPED AT 2 MINUTE
1031	*			INTERVALS IF NO ERRORS OCCUR
1032	*			DATA SET UP ALL TEST DATA FOR SUMMARY
1033	*			TYPEOUT IF REQUESTED
1034	*			*****
1035	*			NOTE ** TO LOOP ON THE G C T INSTRUCTION , SET TAD 1 TO 1

# PROGRAM ADDRESSABLE CLOCK TEST

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MO03 INSTRUCTION

PGLIN	LABEL	OPCODE	OPERAND	CT	ADDRS	MO03 INSTRUCTION
1037	*		***** STANDARD TADS *****			
1038		ORG	1000		01000	
1039	*		NOT 1			
1040	TAD0	DC	DO NOT	1	01000	
1041	TAD1		DO NOT	1	01001	
1042	TAD2		DO NOT	1	01002	
1043	TAD3		DO NOT	1	01003	
1044						
1045	*		***** SPECIAL TADS *****			
1046						
1047	TAD4	DC	DO NOT	1	01004	
1048						
1049						
1050			*TEST SET UP IN THE NOT 1 CONDITION*			
1051			AND WILL ONLY CHECK FOR A 1			
1052	GMWM	DCM	G	1	01005	
1053						
1054	*					
1055						
1056	ALTER	SBR	ALTRXT65	7	01006	G 01073 B
1057	ENTER	RCP	ADDRES64	10	01013	M %TO 01048 R
1058		BNT1	ALTRXT	7	01023	R 01068 B
1059		BEX1	ENTER,M	7	01030	R 01013 M
1060		BA1	ADDRES	7	01037	R 01044 M
1061	ADDRES	RCPW	00000	10	01044	L %TO 00000 R
1062		BEX1	ADDRES,M	7	01054	R 01044 M
1063		BA1	%E1	7	01061	R 01068 M
1065	ALTRXT	B	00000	7	01068	J 00000

\*PROGRAM ALTER ROUTINE

STORE RETURN ADDR  
ENTER LOCATION TO BE ALTERED  
INQ NOT FROM CONSOLE  
TRY AGAIN IF 1/2/4/8  
ENTER DATA INTO ADDRES SPECIFIED

RETURN TO PROGRAM

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MOC3

CT ADDRS INSTRUCTION

## PROGRAM ADDRESSABLE CLOCK TEST

PGLIN	LABEL	CFCCD	OPERANC	CONTROL INFORMATION	CT	ADDRS	INSTRUCTION
1067		CRG	1230	CONTROL INFORMATION		01230	
1068		CC	a	NOT USED	12	01241	
1069		CCW	a12a	USE 88E 1C CHECK FOR A 1 BIT	2	01243	
1070			a0a	IN SYSTEM CARD LOCATION - SYS820	1	01244	
1071			a2590Ta	SEQ# 259 4K SYS CRD ONLY	5	01249	
1072							
1073	TESTID	CCW	aMCO3a	TEST IDENTIFICATION	4	01253	
1074	LEVEL E	CC	aEa	SUFFIX LEVEL	1	01254	
1075							
1076		CRG	1256	*SYSTEM CONTROL CARD		01256	
1077	SYS1	CC	a a	SYSTEM TYPE	1	01256	
1078				C 1410 STD			
1079				I 1410 ACC			
1080				X 7C10			
1081		CC	a	a NOT INTERRCGATED	15	01271	
1082			a a		4	01275	
1083	820 CC	CC	a a	A 1 FOR PROGRAM ADDRESSABLE CLOCK	1	01276	
1084		CC	a	a NOT INTERRCGATED	12	01288	
1085							
1086		CRG	AL1RX1E7			01075	

PGLIN	LABEL	CPCCD	OPERANC	CT	ADCRS	INSTRUCTION
1088	SETUP	PRCM	START,1	12	01075	C 02000 OCC01 M
1089		PRCH		1	01087	D
1090		B	TYPEIT	7	01088	J 03539
1091		CCW	AMCC3D2,G	5	01099	
1092		ZA	TENCPU,DT4	11	01101	01304 03615
1093		ZA		1	01112	
1094		ZA		1	01113	
1095		ZA		1	01114	
1096		BCE	PRETST,SYS1,0	12	01115	01337 01256 C
1097		ZA	EYECPU,DT4	11	01127	01320 03615
1098		ZA		1	01138	
1099		ZA		1	01139	
1100		ZA		1	01140	
1101		BCE	PRETST,SYS1,1	12	01141	01337 01256 I
1102		ZA	XXCPU,DT4	11	01153	01336 03615
1103		ZA		1	01164	
1104		ZA		1	01165	
1105		ZA		1	01166	
1106		BCE	PRETST,SYS1,X	12	01167	01337 01256 X
1107		B	TYPEIT	7	01179	J 03539
1108		CCW	ANC SYS CRD2,G	10	01195	
1109		H	SETUP	6	01197	01075
1110		H		1	01203	.
1111		CRG	1289		01289	
1112		CCW	0354	4	01292	
1113			0232	4	01296	
1114			0252	4	01300	
1115			0265	4	01304	
1116	TENCPU		0335	4	01308	
1117			0150	4	01312	
1118			0212	4	01316	
1119			0220	4	01320	
1120	EYECPU		0114	4	01324	
1121			0066	4	01328	
1122			0072	4	01332	
1123	XXCPU		0076	4	01336	

## PROGRAM ADDRESSABLE CLOCK TEST

PGLIN	LABEL	OPCOD	OPERAND	CT	ADDRS	INSTRUCTION
1125	*					*PRELIMINARY TEST OF THE CLOCK
1126						
1127	*					* STORE TIME - WAIT FOR A CHANGE
1128						
1129	PRETST	BNQ	ALTER	7	01337	J 01006 Q
1130		BCE	REQLUP,IAD1,1	12	01344	B 03422 01001 I
1131	STORE1	STC	TIME1	7	01356	G 01714 I
1132		B	DELAY1	7	01363	J 03495
1133		BCE	DELAYO,TIME1-4,0	12	01370	B 01552 01710 C
1134		BCE	BZYCK1,TIME1-4,9	12	01382	B 01403 01710
1135		B	ERROR1	7	01394	J 01687
1136		B	MESGE0	7	01401	J 01759
1137						
1138	*					* I.D. A 9 AT TIME 1
1139						
1140	BZYCK1	C	TIME1,09999990	11	01408	C 01714 03687
1141		BE	RDYCHK	7	01419	J 01440 S
1142		B	ERROR1	7	01426	J 01687
1143		B	MESGE3	7	01433	J 01873
1144	RDYCHK	STC	TIME2	7	01440	G 01750 T
1145		BCE	START1,TIME2-4,0	12	01447	B 02007 01746 C
1146		BCE	BZYCK2,TIME2-4,9	12	01459	B 01492 01746
1147		B	ERROR1	7	01471	J 01687
1148		B	ERROR2	7	01478	J 01723
1149		B	MESGE1	7	01485	J 01788
1150	BZYCK2	C	TIME2,09999990	11	01492	C 01750 03687
1151		BE	STUCKE	7	01503	J 01531 S
1152		B	ERROR1	7	01510	J 01687
1153		B	ERROR2	7	01517	J 01723
1154		B	MESGE3	7	01524	J 01873
1155	STUCKE	B	ERROR1	7	01531	J 01687
1156		B	ERROR2	7	01538	J 01723
1157		B	MESGE4	7	01545	J 01906
1158						

## PROGRAM ADDRESSABLE CLOCK TEST

PGLIN	LABEL	OPCODE	OPERAND	CT	ADDRS	INSTRUCTION
1160	*					* I.D. A 0 AT TIME 1
1161						
1162	DELAYO	STC	TIME2	7	01552	G 01750 T
1163		A	DIO,DLAYCT	11	01559	A 03603 03637
1164		BCE	BZYCK3,TIME2-4,9	12	01570	B 01627 01746 9
1165		BCE	STOPEO,DLAYCT-7,7	12	01582	B 01666 03630 7
1166		BCE	DELAYO,TIME2-4,0	12	01594	B 01552 01746 0
1167		B	ERROR1	7	01606	J 01687
1168		B	ERROR2	7	01613	J 01723
1169		B	MESGE1	7	01620	J 01788
1170	BZYCK3	C	TIME2,99999999	11	01627	C 01750 03687
1171		BE	START1	7	01638	J 02007 S
1172		B	ERROR1	7	01645	J 01687
1173		B	ERROR2	7	01652	J 01723
1174		B	MESGE3	7	01659	J 01873
1175	STOPEO	B	ERROR1	7	01666	J 01687
1176		B	ERROR2	7	01673	J 01723
1177		B	MESGE2	7	01680	J 01829
1178	*					* FAILURE TO ADVANCE INDICATED



## PROGRAM ADDRESSABLE CLCK TEST

PGLIN	LABEL	OPCODE	OPERAND	CI	ADDRS	INSTRUCTION
1180	*					
1181						
1182	ERROR1	SBR	EREXT1&5	7	01687	G 01721 B
1183		B	TYPEIT	7	01694	J 03539
1184	TIME1	DCW	a* TIME 1 a,G	14	01714	
1185	EREXT1	B	00000	7	01716	J 00000
1186						
1187	ERROR2	SBR	EREXT2&5	7	01723	G 01757 B
1188		B	TYPEIT	7	01730	J 03539
1189	TIME2	DCW	a* TIME 2 a,G	14	01750	
1190	EREXT2	B	00000	7	01752	J 00000
1191						
1192	MESGE0	B	TYPEIT	7	01759	J 03539
1193		DCW	a* INVALID I.D.a,G	14	01779	
1194		B	PRETST	7	01781	J 01337
1195						
1196	MESGE1	B	TYPEIT	7	01788	J 03539
1197		DCW	a* ADVANCED TO INVALID I.D.a,G	26	01820	
1198		B	PRETST	7	01822	J 01337
1199						
1200	MESGE2	B	TYPEIT	7	01829	J 03539
1201		DCW	a* FAILURE TO ADVANCE INDICATEDa,G	30	01865	
1202		H	STGRE1	6	01867	J 01356
1203						
1204	MESGE3	B	TYPEIT	7	01873	J 03539
1205		DCW	a* READ OUT FAILUREa,G	18	01897	
1206		B	PRETST	7	01899	J 01337
1207						
1208	MESGE4	B	TYPEIT	7	01906	J 03539
1209		DCW	a* STUCK ON BUSY ORa,G	18	01930	
1210		B	MESGE3	7	01932	J 01873
1211						
1212	*					

\*\*\*\*\*

PGLIN	LABEL	OPCODE	OPERAND	CT	ADDRS	INSTRUCTION
1214		ORG	2000		02000	
1215	*					PROGRAM BEGINS HERE
1216						* MAIN BODY OF TEST
1217	*					*READ CLOCK
1218						
1219	START	B	SETUP	7	02000	J 01075
1220	START1	S	TOTAL	6	02007	S 03629
1221		S	PASSNO	6	02013	S 03538
1222		S	BZTIME	6	02019	S 03621
1223		BNQ	ALTER	7	02025	J 01006 Q
1224		BCE	REQLOP,TAD1,1	12	02032	B 03422 01001 1
1225	STOREE	STC	TIMEE	7	02044	G 03642 T
1226		B	DELAY1	7	02051	J 03495
1227	STOREA	STC	TIMEA	7	02058	G 03647 T
1228		C	TIMEE,TIMEA	11	02065	C 03642 03647
1229		BU	STOREE	7	02076	J 02044 /
1230		BCE	STOREE,TIMEA-4,9	12	02083	B 02044 03643 9
1231	STOREB	STC	TIMEB	7	02095	G 03657 T
1232		BCE	STOREB,TIMEB-4,0	12	02102	B 02095 03653 0
1233		C	TIMEB,09999999	11	02114	C 03657 03687
1234		BU	EROR5B	7	02125	J 02966 /
1235	STOREC	STC	TIMEC	7	02132	G 03662 T
1236		A	DT3,BZTIME	11	02139	A 03611 03621
1237		BCE	STOREC,TIMEC-4,9	12	02150	B 02132 03658 9
1238		B	DELAY1	7	02162	J 03495
1239		A	DLAYCT,TOTAL	11	02169	A 03637 03629
1240		A	BZTIME,TOTAL	11	02180	A 03621 03629
1241	STORED	STC	TIMED	7	02191	G 03672 T
1242		A	DT4,TOTAL	11	02198	A 03615 03629
1243		BCE	STORED,TIMED-4,0	12	02209	B 02191 03668 0
1244		C	TIMED,09999999	11	02221	C 03672 03687
1245		BU	EROR50	7	02232	J 02997 /
1246	STOREE	STC	TIMEE	7	02239	G 03677 T
1247		BCE	STOREE,TIMEE-4,9	12	02246	B 02239 03673 9
1248		BNQ	ALTER	7	02258	J 01006 Q

# PROGRAM ADDRESSABLE CLOCK TEST

M003 PAGE 21  
CT ADDRS INSTRUCTION

PGLIN	LABEL	OPCODE	OPERAND		CT	ADDRS	M003	PAGE
1250	*			*CHECK RESULTS OF AN ADVANCE				21
1251								
1252	CHKADV	C	8ZTIME-3,04600	460 MS MAX. BUSY TIME	11	02265	C 03618 03690	
1253		BL	ERROR6	BUSY TOO LONG , ERROR ROUTINE	7	02276	J 03075 T	
1254		C	BZTIME-3,02300	LOWER LIMIT	11	02283	C 03618 03693	
1255		BH	ERROR6	BUSY TOO SHORT	7	02294	J 03075 U	
1256		C	TOTAL-6,0610	CHECK UPPER LIMIT	11	02301	C 03623 03695	
1257		BL	ERROR7	TOO LONG	7	02312	J 03136 T	
1258		C	TOTAL-6,0590	CHECK LOWER LIMIT	11	02319	C 03623 03697	
1259		BH	ERROR7	TOO SHORT	7	02330	J 03136 U	
1260		CW	ERCR8A&1	SET SWITCHES FOR	6	02337	0 03230	
1261		SW	EROR8B&1	ERROR TYPE OUTS	6	02343	0 03262	
1262		MLNA	TIMEA,TIMEA1	SAVE TIME A ADD TO TIME A1	12	02349	D 03647 03652 /	
1263		BCE	ADDONE,TIMEA1,2	.CLOCK ADVANCES FROM 2 TO 3	12	02361	B 02396 03652 2	
1264		BCE	ADDONE,TIMEA1,7	.OR FROM 7 TO 8	12	02373	B 02396 03652 7	
1265		A	&1,TIMEA1	. CLOCK ADVANCES FROM 0 TO 2	11	02385	A 03698 03652	
1266	ADDONE	A	&1,TIMEA1	. 3 TO 5 , 5 TO 7, 9 TO 0	11	02396	A 03698 03652	
1267		C	TIMEA1,TIMEC	COMPARE TIME A ADJUSTED TO TIME C	11	02407	C 03652 03662	
1268		BE	SWITCH	0 K CONTINUE	7	02418	J 02461 S	
1269		C	TIMEA1,0024000	RESETTING ON NEXT PASS	11	02425	C 03652 03703	
1270		BU	ERROR8		7	02436	J 03197 /	
1271		C	TIMEC,0000000	RESET TO 00000	11	02443	C 03662 03708	
1272		BU	EROR8C	SHOULD 8E EQUAL	7	02454	J 03222 /	
1273	SWITCH	SW	ERCR8A&1	SET SWITCHES FOR	6	02461	0 03230	
1274		CW	EROR8B&1	ERROR TYPE OUTS	6	02467	0 03262	
1275		MLNA	TIMEC,TIMEC1	SAVE TIME C ADD TO TIME C1	12	02473	D 03662 03667 /	
1276		BCE	ADOUNO,TIMEC1,2	REPEAT AS DONE FOR A & C ABOVE	12	02485	B 02520 03667 2	
1277		BCE	ADOUNO,TIMEC1,7		12	02497	B 02520 03667 7	
1278		A	&1,TIMEC1		11	02509	A 03698 03667	
1279	ADDOUNO	A	&1,TIMEC1		11	02520	A 03698 03667	
1280		C	TIMEC1,TIMEE	COMPARE TIME C ADJUSTED TO TIME E	11	02531	C 03667 03677	
1281		BE	SETIME		7	02542	J 02585 S	
1282		C	TIMEC1,0024000	RESETTING ON NEXT PASS	11	02549	C 03667 03703	
1283		BU	EROR8		7	02560	J 03197 /	
1284		C	TIMEE,0000000	RESET TC 00000	11	02567	C 03677 03708	
1285		BU	ERCR8C	SHOULD 8E EQUAL	7	02578	J 03222 /	

## PROGRAM ADDRESSABLE CLOCK TEST

PGLIN	LABEL	OPCOD	OPRAND	CT	ADDRS	INSTRUCTION
1287	SETIME	MLNA	TIMEE,TIME	12	02585	D 03677 02619 /
1288		B	TYPEIT	7	02597	J 03539
1289	TIME	DCW	@CLOCK TIME 00000@,G	16	02619	
1290		BNQ	ALTER	7	02621	J 01006 Q
1291		BCE	DATA,IAD4,1	12	02628	B 02647 01004 1
1292		B	INREQ	7	02640	J 02887
1293	DATA	MLNA	TIMEA,MESGEA	12	02647	D 03647 02749 /
1294		MLNA	TIMEB,MESGEB	12	02659	D 03657 02769 /
1295		MLNA	TIMEC,MESGEC	12	02671	D 03662 02789 /
1296		MLNA	TIMED,MESGED	12	02683	D 03672 02809 /
1297		MLNA	TIMEE,MESGEE	12	02695	D 03677 02829 /
1298		MLNA	BZTIME-3,RESUL1-3	12	02707	D 03618 02850 /
1299		MLNA	TOTAL-3,MINUTE-3	12	02719	D 03626 02882 /
1300		B	TYPEIT	7	02731	J 03539
1301	MESGEA	DCW	@TIME A @,G	12	02749	
1302		B	TYPEIT	7	02751	J 03539
1303	MESGEB	DCW	@TIME B @,G	12	02769	
1304		B	TYPEIT	7	02771	J 03539
1305	MESGEC	DCW	@TIME C @,G	12	02789	
1306		B	TYPEIT	7	02791	J 03539
1307	MESGED	DCW	@TIME D @,G	12	02809	
1308		B	TYPEIT	7	02811	J 03539
1309	MESGEE	DCW	@TIME E @,G	12	02829	
1310		B	TYPEIT	7	02831	J 03539
1311	RESULT	DCW	@BUSY TIME 000 MS@,G	16	02853	
1312		B	TYPEIT	7	02855	J 03539
1313	MINUTE	DCW	@TIME TO ADVANCE 00000 MS@,G	24	02885	
1314	INREQ	BNQ	ALTER	7	02887	J 01006 Q
1315		BCE	REQLUP,IAD1,1	12	02894	B 03422 01001 1
1316		BCE	START1,IAD3,1	12	02906	B 02007 01003 1
1317		A	@1,PASSNO	11	02918	A 03698 03538
1318		BCE	*@8,PASSNO,3	12	02929	B 02948 03538 3
1319		B	START1	7	02941	J 02007
1320		B	TYPEIT	7	02948	J 03539
1321		DCW	@ECJ@,G	3	02957	
1322		B	LOADER	7	02959	J 00400
						CALL IN NEXT TEST

PROGRAM ADDRESSABLE CLOCK TEST

PGLIN	LABEL	CPCCD	OPERANC	CT	ADRS	INSTRUCTION
1324	*		*SET UP ERRCR MESSAGES			
1325						
1326	ERRCR5B	MLCS	200,MESGE5-26 SET UP MESSAGE	12	02966	D 03709 03047 3
1327		MLNA	TIMEB,MESGE5-16 SET TIME B IN MESSAGE 5	12	02978	D 03657 03057 /
1328		B	ERRCR5	7	02990	J 03021
1329	ERRCR5C	MLCS	200,MESGE5-26 SET UP MESSAGE	12	02997	D 03710 03047 3
1330		MLNA	TIMEC,MESGE5-16 SET TIME D IN MESSAGE 5	12	03009	D 03672 03057 /
1331	ERRCR5 E	MLCWA	START66,ERREXT66 START AGAIN ON THIS ERRCR	12	03021	D 02006 03487 X
1332		B	TCERRT	7	03033	J 03335
1333	MESGE5	CCW	2* TIME X WAS CCCCC EXPECTED 99999a,G	34	03073	
1334	*		**NCT A BUSY SIGNAL INDICATION BUT A READOUT FAILURE			
1335						
1336	ERRCR6	SER	ERREXT65 STORE ADDRESS FOR RETURN	7	03075	G 03486 B
1337		MLNA	BZTIME-3,MESGE6-19 SET ACTUAL BUSY TIME IN MESGE6	12	03082	D 03618 03115 /
1338		B	TCERRT	7	03094	J 03335
1339	MESGE6	CCW	2* BUSY TIME CCO MS - NCT IN SPECS a,G	34	03134	
1340						
1341	ERRCR7	SER	ERREXT65 STCRE ADDRESS FOR RETURN	7	03136	G 03486 B
1342		MLNA	TOTAL-3,MESGE7-11 SET TOTAL ADVANCE TIME IN MESGE7	12	03143	D 03626 03184 /
1343		B	TCERRT	7	03155	J 03335
1344	MESGE7	CCW	2* TIME TO ADVANCE CCCCC MS - CHECKa,G	34	03195	
1345						
1346	ERRCR8	SER	ERREXT65 STCRE ADDRESS FOR RETURN	7	03197	G 03486 B
1347		A	E18,ERREXT65 ADJUST ERRCR EXIT ADDRESS	11	03204	A 03712 03486
1348		B	ERRCR8A	7	03215	J 03229
1349	ERRCR8C	SER	ERREXT65 STCRE ADDRESS FOR RETURN	7	03222	G 03486 B
1350	ERRCR8A	NCPWM		1	03229	N
1351		B	ERRCR8B SKIP A-C, DC C-E	7	03230	J 03261
1352		MLNA	TIMEA,MESGE8-18 .SET CLOCK TIMES IN ERRCR MESSAGE	12	03237	D 03647 03315 /
1353		MLNA	TIMEC,MESGE8 .TIME A SHOULD EQUAL TIME C	12	03249	D 03662 03333 /
1354	ERRCR8B	NCPWM		1	03261	N
1355		B	READY	7	03262	J 03293
1356		MLNA	TIMEC,MESGE8-18 .SET CLOCK TIMES IN ERRCR MESSAGE	12	03269	D 03662 03315 /
1357		MLNA	TIMEE,MESGE8 .TIME C SHOULD EQUAL TIME E	12	03281	D 03677 03333 /
1358	READY	B	TCERRT	7	03293	J 03335
1359	MESGE8	CCW	2* TIME WAS CCCCC ADVANCED TO CCCCCa,G	34	03333	

PROGRAM ADDRESSABLE CLOCK TEST

PGLIN	LABEL	CPCCD	OPERAND	CT	ADDRS	INSTRUCTION
1361	*					* SET UP ERROR ROUTINE
1362						
1363	TCERRT	SER	MOVE\$5	7	03335	G 03347 B
1364	MCVE	MRCWG	00CCC,BUFFER-33	12	03342	D 00000 03368 L
1365		B	ERRCRT	7	03354	J 03361
1366						
1367	*					* ERROR ROUTINE AND G C T LOOP
1368						
1369	ERRCRT	B	TYPEIT	7	03361	J 03539
1370	BUFFER	CCW	a	34	03401	
1371		BCE	SET4RR,TAD1,1	12	03403	B 03429 01001 I
1372		B	ERREXT	7	03415	J 03481
1373						
1374	RECLUP	SER	ERREXT\$5	7	03422	G 03486 B
1375	SET4RR	MRCW	AUT0RR,1	12	03429	D 03488 00001 M
1376		MRCW		1	03441	D
1377	LCCP	BNG	ALTER	7	03442	J 01006 Q
1378		STC	TIME\$	7	03449	G 03682 T
1379		BCE	LCCP,TAD1,1	12	03456	B 03442 01001 I
1380		MRCW	START,1	12	03468	D 02000 00001 M
1381		MRCW		1	03480	D
1382						
1383	ERREXT	B	00CCC	7	03481	J 00000
1384						
1385	AUT0RR	B	LCCP	7	03488	J 03442

PROGRAM ADDRESSABLE CLOCK TEST

MO03 INSTRUCTION

PGLIN	LABEL	OPCODE	OPERAND	CT	ADDRS	INSTRUCTION
1387	*		* DELAY 1 SEC ROUTINE			
1388	*		* APPROX 1 SEC DELAY IS ADDED TO ALLOW FOR			
1389	*		* CONTACT BOUNCE TO SUBSIDE PREVENTING THE			
1390	*		* ADVANCE OF THE PROGRAM ON PREMATURE INDICATIONS			
1391	*					
1392	DELAY1	SBR	DLAEXT&5	7	03495	G 03524 B
1393		S	DLAYCT	6	03502	S 03637
1394	ADITUP	A	DT1,DLAYCT	11	03508	A 03607 03637
1395	DLAEXT	BCE	00C00,DLAYCT-6,1	12	03519	B 00000 03631 1
1396		B	ADITUP	7	03531	J 03508
1397			KEEP ON GOING			
1398	PASSND	DCW	@ &	1	03538	
1399						
1400	*		TYPING ROUTINE			
1401						
1402	TYPEIT	SBR	TYPE&8	7	03539	G 03554 B
1403	TYPE	WCP	00C00	10	03546	M %10 00000 W
1404		SBR	TYPEXT&5	7	03556	G 03582 B
1405		BCB1	TYPE	7	03563	R 03546 2
1406		BA1	*&1	7	03570	R 03577 M
1407	TYPEXT	B	00000	7	03577	J 00000
1408		H	RETURN TO MAIN PROGRAM	1	03584	.

PGLIN	LABEL	OPCODE	OPERAND	CT	ADDRS	M003	INSTRUCTION
1410		ORG	*EX00		03600		
1411	DT0	DCW	£0000	4	03603		
1412	DT1		£0C00	4	03607		
1413	DT3		£0000	4	03611		
1414	DT4		£0000	4	03615		
1415	BZTIME		£000000	6	03621		
1416	TOTAL		£00000000	8	03629		
1417	DLAYCT		£00000000	8	03637		
1418							
1419	TIME£		00000	5	03642		
1420	TIMEA		00000	5	03647		
1421	TIMEA1		00000	5	03652		
1422	TIMEB		00000	5	03657		
1423	TIMEC		00000	5	03662		
1424	TIMEC1		00000	5	03667		
1425	TIME D		00000	5	03672		
1426	TIME E		00000	5	03677		
1427	TIME X		00000	5	03682		
1428		L TORG			03683		
1428			£999999a	5	03687		
1428			£460a	3	03690		
1428			£230a	3	03693		
1428			£61a	2	03695		
1428			£59a	2	03697		
1428			£1	1	03698		
1428			£02400a	5	03703		
1428			£00000a	5	03708		
1428			£8a	1	03709		
1428			£0a	1	03710		
1428			£18	2	03712		
1429		END	START				

J02000

END OF ASSEMBLY